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Short Communication

Developing a Best-Evidence Pre-employment Medical Examination: An Example from the Construction Industry

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ABSTRACT

The Dutch construction industry has introduced a compulsory preemployment medical examination (PE-ME). Best-evidence contents related to specific job demands are, however, lacking and need to be gathered. After the identification of job demands and health problems in the construction industry (systematic literature search and expert meeting), specific job demands and related requirements were defined and instruments proposed. Finally, a work ability assessment was linked to the instruments' outcomes, resulting in the modular character of the developed PE-ME. Twenty-two specific job demands for all Dutch construction jobs were identified, including kneeling/squatting, working under time pressure, and exposure to hazardous substances. The next step was proposing self-report questions, screening questionnaires, clinical tests, and/or performance-based tests, leading to a work ability judgment. "Lifting/carrying" is described as an example. The new modular PE-ME enables a job-specific assessment of work ability to be made for more than 100 jobs in the Dutch construction industry.

1. Introduction

With the goals of identifying and monitoring any function or health abnormality in prospective employees, preemployment medical examinations (PE-ME) rely traditionally on the classic assessment of specific medical conditions or substance abuse [1,2]. However, it has been suggested that this is not optimally relevant for fitness-for-work decisions [1,2]. The assessment of fitness for work related to physical and mental job demands seems to be a better predictor than solely searching for a medical diagnosis [2,3]. In addition, PE-MEs might be regulated nationwide by law or through guidelines in a specific occupational sector, having consequences for the development and application of PE-MEs. In the Netherlands, the Dutch Medical Examination Act (1998) and Guidelines for Preemployment Examination (2005) were developed in order to standardize and regulate physical and medical selection procedures such as PE-MEs [4,5]. Concordantly, occupational physicians performing PE-MEs must assess human capacities in close relation to the specific job demands and related health requirements [4,5]. Specific job demands are defined as those demands that exceed exposure safety levels or average human capacities to meet such demands on a daily basis and that cannot be eliminated by current state-of-the-art measures, leading to an increased risk of work-related health problems or diminished safety [5]. The construction industry is characterized by jobs in which the workers are known to be at risk for adverse health effects or accidents because of their specific occupational exposure [6,7]. These specific job demands might even have public health implications because of the health risks that construction workers may impose upon others (e.g., colleagues and the public) during the course of their work [6,7]. Consequently, and following our laws, the Dutch construction industry has introduced a compulsory PE-ME for the jobs with specific job demands. However, best-evidence contents related to specific job demands for the development of a PE-ME are lacking. In addition, with regard to the various jobs in the Dutch construction industry, a modular character of a compulsory PE-ME needs to be ensured. This paper briefly describes the development of a modular PE-ME for all high-demand jobs in the

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Dutch construction industry. As an example, one specific job demand is briefly described.

A systematic literature search of several electronic databases was conducted, accompanied by a qualitative research (expert meeting among occupational physicians, ergonomists, occupational hygienists, safety experts, psychologists) in order to identify and validate the job demands and health problems in the construction industry. To assign specific job demands, we used scientific literature (systematic reviews and original studies) and/or health and safety-related sources (laws, norms, guidelines) to assess two questions for each identified job demand: (1) Does its exposure exceed exposure safety levels or average human capacities to meet such demands on a daily basis? (2) Can its exposure be eliminated by current state-of-the-art measures? [4,5]. For all specific job demands assigned, specific job requirements were defined, and instruments (self-report questions, screening questionnaires, clinical tests, and/or performance-based tests) proposed, taking criteria related to measurement quality, i.e. clinimetric properties, into consideration [8]. Based on the outcomes of all selected instruments, a decision rule was set up for the judgment about an individual's work ability as [5,9]:

- 'fit to work': the potential employee presents no medical restrictions or barriers in health requirements for a given job;
- 'conditionally fit to work': the potential employee presents medical restrictions or barriers in health requirements for a given job that are expected to disappear within a few days;
- 'unfit to work': the potential employee presents medical restrictions or barriers in health requirements for a given job, leading to a significant increased risk for health of safety problems for himself/herself or others.

Finally, a selection of relevant high-demand construction jobs for each specific job demand was proposed, leading to the modular character of the developed PE-ME [5,9].

A modular PE-ME for all high-demand jobs in the Dutch construction industry was developed, based on 22 specific identified job demands (standing, walking, ascending/descending stairs, clambering/climbing, sitting in an awkward posture, kneeling/squatting, pushing/pulling, lifting/carrying, repeated movements, working with elevated arms, working with a bent/twisted back, working with treadles, working under time pressure, alertness/judgment capacity, exposure to hand/arm vibration, exposure to whole body vibration, working in small enclosed spaces, working in compressed air, extreme weather conditions, working on elevated surfaces, exposure to hazardous substances, exposure to biological agents), related job requirements and instruments [9].

2. A specific job demand as an example

2.1. Specific job requirements related to the specific job demand "lifting/carrying"

The job candidate has no limitation of the musculoskeletal system and no limitation of the cardiovascular system to be able to:

(1) lift/carry different loads for up to 5 hours of a workday;
(2) lift/carry during a workday loads of 5 kg at a frequency of three times per minute;
(3) lift/carry during a workday loads of 10 kg at a frequency of two times per minute; and
(4) lift/carry during a workday loads of 15 kg at a frequency of once per 5 minutes [9].

2.2. Instruments and job selection

A combination of three self-report health questions and one performance-based test is proposed to measure the specific job requirements related to "lifting/carrying" (Table 1). Prior to this performance-based test, a valid questionnaire to recognize whether physical activities can or cannot be performed safely is used as a necessary condition (Table 1) [10]. Then, depending on the outcomes of all proposed instruments, and following a decision rule, the occupational physician gives the work ability assessment of the prospective employee [9].

This paper briefly presents the development of a new modular PE-ME for all jobs in the Dutch construction industry and how its content was defined. This new PE-ME relies on evidence-based contents that are not automatically applied to all construction workers, but can be configured for the specific job demands of a particular job. Therefore, such a modular PE-ME avoids the unnecessary medical evaluation of aspects that are not relevant for a particular job, improving its practicability. One particular innovative aspect of the new modular PE-ME is the selection or development of performance-based tests in order to assess specific physical job requirements as functionally as possible. In combination with information provided by self-report questions, screening questionnaires, and/or clinical tests, physicians could have access to a complete and balanced overview of relevant information in order to evaluate whether a prospective employee is either 'fit to work', 'conditionally fit to work', or 'unfit to work'. In addition, previous

Table 1
Instruments related to the specific job requirements of "lifting/carrying" [8]

Self-report health questions
1. Do you have any trouble lifting or carrying objects up to 20 kg regularly during a work day? (yes; no; unknown)
2. Do you have any trouble lifting or carrying objects of between 20 kg and 25 kg occasionally during a work day? (yes; no; unknown)
3. At this moment, do you have any ache or pain in the following body regions? (yes; no)
[neck; upper back; shoulder; elbow; upper arm; under arm; wrist/hand; lower back; hip; knee; upper leg; lower leg; ankle/foot]
Performance-based test
Based on a Functional Capacity Evaluation (FCE) method, three different protocols with three different intensities, i.e. loads (10 kg, 15 kg, and 25 kg), are assessed in accordance with the following instructions and steps:
(1) lift the toolbox (10 kg, 15 kg, or 25 kg) from the ground (20 cm) with two hands;
(2) lift the toolbox (10 kg, 15 kg, or 25 kg), turn 90° and put the toolbox down at hip height;
(3) lift the toolbox (10 kg, 15 kg, or 25 kg) from hip height with two hands;
(4) turn 90° and carry the toolbox (10 kg, 15 kg or 25 kg) 5 m;
(5) turn back and bring back the toolbox (10 kg, 15 kg, or 25 kg) 5 m;
(6) put the toolbox (10 kg, 15 kg, or 25 kg) back on the ground (20 cm).
Protocol 10 k (toolbox)
Frequency = 2 times per min for lifting (Steps 1 to 3) and 2 times per min for carrying (Steps 4 to 6)
Duration steps 1 to 6 = 30 s
Total = 20 times steps 1 to 6; up to 10 min
Protocol 15 kg (toolbox)
Frequency = once within 5 min for lifting (steps 1 to 3) and once within 5 min for carrying (steps 4 to 6)
Duration steps 1 to 6 = 5 min maximum
Total = 2 times steps 1 to 6; up to 10 min
Protocol 25 kg (toolbox)
Frequency = once for lifting (Steps 1 to 3) and once for carrying (Steps 4 to 6)
Duration Steps 1 to 6 = 10 min maximum
Total = once Steps 1 to 6; up to 10 min

studies have shown that physicians have a positive view on the usefulness of complementary information derived from performance-based tests for their assessment of physical work ability [11]. However, the clinimetric properties, i.e., reproducibility and validity of the performance-based tests within the new PE-ME, need to be evaluated [8,9]. The new modular PE-ME enables the job-specific assessment of work ability for more than 100 jobs in the Dutch construction industry, thereby helping to prevent injuries and disorders in job candidates. To explore whether this PE-ME is feasible in occupational medicine in the Dutch construction industry, a pilot implementation is recommended to identify the necessary medical, technical, organizational, and financial conditions for its nationwide implementation in the construction sector.

Conflicts of interest

All authors have no conflicts of interest to declare.

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